

Assessing Perceptions and Medication Disposal Habits in Rural Michigan

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Abstract

Background: Inadequate or inappropriate medication disposal is a public health concern that may lead to increased community risk of accidental poisonings, substance misuse, and environmental pollution.

Objective: The study's primary objective was to assess medication disposal knowledge and practices of Michigan residents living in rural, underserved areas. Secondary objectives included determining baseline perceptions of at-home drug disposal kits and examining the impact of an educational video intervention on at-home drug disposal kit perceptions.

Methods: To measure the objectives, an online 15-question survey was deployed to the general public via convenience sampling from local organizations working with drug disposal. The survey questions assessed medication disposal knowledge and practices in underserved, rural Michigan. Participant responses were assessed categorically and numerically.

Results: Inclusion criteria were met by 97 survey participants. Results indicated that Michigan rural residents, regardless of various demographic factors, would benefit from increased drug disposal education. Specifically, at-home drug disposal kits and medication drop boxes have the highest need for additional education. Perceptions related to home disposal safety and ease of use improved significantly with an educational video intervention.

Conclusion: All rural residents, regardless of demographics, would benefit from increased drug disposal education. A short, educational video can impact thoughts and attitudes related to at-home drug disposal kits. Similar interventions may be successful in other rural, underserved areas.

Key words: medication, disposal, safety, perceptions

BACKGROUND

Proper medication disposal is crucial for the public's overall health and safety. Current recommendations vary on methods that are appropriate for the removal of unused or expired medication from homes. The Food and Drug Administration (FDA) recommends utilization of drug take-back programs or medication drop boxes as first-line options for disposal. If such options are not available in an individual's community, the FDA alternatively recommends disposal of medication in the trash and flushing drugs down the sink or toilet. Conversely, the Environmental Protection Agency (EPA) does not condone the FDA's alternative methods and only supports the use of medication take-back programs and drop boxes.^{1,2} Advice provided by local health professionals or law enforcement may also be conflicting for patients regarding safe disposal of unused medications. Overall, differences in recommendations as well as publicly available educational material contributes to confusion and inappropriate drug disposal practices.³

From 2015 to 2020, the amount of medication prescribed or obtained over the counter increased by 24% worldwide. Each year large portions of these medications remain unused or expired in homes.^{4,5} Reasons for medication accumulation include poor patient adherence or stockpiling products for future self-treatment.⁶ Overprescribing, dose changes, and

medications expiring are also reasons patients compile medications and require disposal options.^{5,7} Lastly, limited knowledge about medication disposal options and reduced accessibility to appropriate options contributes to drug accumulation in homes.^{8,9}

Inadequate or inappropriate medication disposal is a public health concern for three main reasons. First, lack of medication disposal increases the risk of accidental poisonings in children and the elderly.^{1,10,11} Second, improper disposal increases substance theft, misuse, and abuse in communities.^{8,10,12} Third, improper medication disposal causes significant environmental harm by contributing to ground, water, and air pollution.^{3-6,8,9,12-15} These public health concerns are especially heightened in rural communities where access to safe medication disposal options is often reduced and substance use disorder may be prevalent.^{16,17}

Numerous strategies exist to improve safe medication disposal in communities. One strategy is increasing the disposal education that pharmacists and physicians provide patients.⁹ as Another method is focusing efforts on rural communities that have less access to safe disposal options.^{16,17} At-home drug deactivation kits are also a novel, rising medication disposal option that may simplify disposal and avoid further confusion.^{2,9,13} Some studies do not show additional benefit from these products compared to opioid disposal education alone.^{18,19} For example, one study found no difference in drug disposal between patients given a disposal kit upon outpatient opioid prescription pickup and individuals who were not provided a kit (OR 1.44, 95% CI of 0.55 – 3.74).¹⁸ Other literature

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does support the ability of these products to increase drug disposal.²⁰⁻²² In fact, one study concluded opioid disposal odds were 3.8 (95% CI of 1.7 – 8.5) times higher for people given an at-home deactivation product compared to those who only received education on medication drop box locations.²²

The primary objective of this study was to assess medication disposal knowledge and practices in Mecosta, Newaygo, and Osceola counties, which are health care provider shortage areas (HPSA).²³ The secondary objective of the study was to evaluate the population's perceptions and acceptance of at-home medication deactivation products at baseline and after an educational video intervention on drug disposal kits.

METHODS

Study Design

This study, Medication Disposal in Rural Michigan, was approved by the Institutional Review Board at Ferris State University. It was completed to aid the Central Michigan Recovery and Education Network (CMREN) located in Big Rapids, Michigan. CMREN is a grass roots, network coalition amplifying substance use disorder prevention, treatment, and recovery initiatives in these counties. They hold many partnerships with local organizations to expand services, including services related to medication disposal. CMREN self-reports that access to medication drop boxes in community pharmacies and police stations is similar in these three counties. Through the primary objective, CMREN aimed to identify demographic groups that would benefit the most from drug disposal education as well as disposal methods requiring the highest focus. With the secondary objective, CMREN aimed to better understand if future distribution of drug disposal kits in the rural counties they serve would be desired or potentially effective if targeted education was provided.

To achieve the study's objectives, a 15-question online survey was designed and implemented utilizing QuestionPro, a web-based survey platform. Responses and data were collected from November 1, 2021 through November 30, 2021. Prior to the survey launching, local organizations working closely with CMREN were asked to submit IRB-approved participation agreements if they were interested in helping with survey distribution for convenience sampling. Organizations had the option to distribute an IRB-approved scripted email, flyer, or both. They were asked to indicate their choice on the participation agreement. All survey recruitment materials contained a link to the survey, which could be accessed via web browser. The flyer additionally had a QR code, which could be scanned by a mobile device. District health departments, a federally qualified health center, substance awareness coalitions, independent pharmacies, and Ferris State University's College of Pharmacy ended up distributing surveys. Beginning November 1st, 2021, organizations that chose the email script utilized their own private, pre-existing patient and staff email lists to recruit participants. Groups distributing flyers

were asked to place them in their waiting areas and hang one at check-in counters for the entire month of November.

Participants were included in the survey if they lived in Mecosta County, Osceola County, or Newaygo County. They were excluded if they were under 18 years old, had never disposed of medication, or lived outside of the counties included in the study.

The first six questions of the survey were multiple choice to gather demographic information. Factors assessed included county of residence, age, gender, race/ethnicity, highest education completed, and occupation. The next eight questions were a mix of multiple choice, select all that apply, short answer, and ranking style questions focused on participants' medication disposal knowledge and practices. One question was also included asking participants who they felt was responsible for creating awareness about proper drug disposal practices.

Then, in the final survey question, participants were asked to rank three statements before and after an educational video on at-home drug disposal kits. This video included 10 seconds of introduction to at-home drug disposal, one minute of educational material related to safe at-home disposal, and 30 seconds of summary points, which highlighted how to access additional information. Approval was obtained from one drug disposal kit company to utilize an image that demonstrates how drug disposal kits work. Then, content included an explanation of safety points and how disposal kits impact the environment. The video was included to better understand knowledge and perceptions specifically surrounding at-home drug deactivation products since they are the newest and least understood method of drug disposal at this time.

To ensure the survey would be understood by respondents as intended, it was reviewed by CMREN partner organizations that regularly provided prevention services in the community. Feedback was collected on the survey contents, grammar, and literacy level. Revisions maintained a 6th grade Flesch-Kincaid reading level. Please refer to **Appendix A** for survey questions, option order, and logic.

Statistical Analysis

For the primary objective, participant survey responses on the drug disposal methods they utilized were assessed categorically and numerically. Categorically, participants were split into two groups, those who always used appropriate drug disposal methods and those who used inappropriate disposal methods some or all the time. In alignment with the EPA, appropriate drug disposal options were defined as medication drop boxes and medication take-back events.² Our study added novel at-home drug deactivation kits due to the rising evidence of their safety and effectiveness.^{2,13, 20-22} All other drug disposal options were considered inappropriate. These included, but were not limited to, medications being thrown in the trash, rinsed down

the sink, flushed, burned, or buried. Relationships between these categories and various demographic factors were assessed using Pearson chi-square tests.

The specific number of appropriate and inappropriate disposal methods utilized by each participant was also assessed. This was done because some participants used a mixture of disposal methods. The count data was normality tested using the Kolmogorov-Smirnov test. With our small sample size, the data was not normally distributed, so non-parametric tests were chosen to assess relationships between disposal method interval data and demographic groups. Mann-Whitney U tests were utilized for demographics with two subgroups. Kruskal-Wallis ANOVA tests were performed for demographics with three or more subgroups.

Lastly, for the secondary objective, Wilcoxon Signed Rank tests were utilized to assess changes in participant perception of at-home drug disposal kits after watching the educational video. This test was chosen because the questions before and after the educational video were ranking style utilizing a Likert scale, and Wilcoxon Signed Rank tests are the preferred analytical test for ordinal data with dependent pre- and post-test samples. All statistical tests described were performed using IBM SPSS 28.0, and a p-value less than 0.05 was considered significant.

RESULTS

The survey had 144 responses. A complete breakdown of participant responses and survey dropouts can be seen in **Figure 1**. 42 participants were excluded from the survey. Of those, 18 participants were excluded because they indicated they had never disposed of medication. Participants that answered this way were asked why they had never disposed of medication. The most common reason was because the participant did not take medication (38.9%). However, other responses included not checking expiration dates (22.2%), keeping medication for future needs (16.7%), and not knowing how to dispose of medication (11.1%). All other exclusions were due to participants not living in the counties of interest.

Of the individuals included, 5 did not complete the survey's demographic or drug disposal questions. The reason for this dropout was not collected. The remaining 97 individuals answered all demographic and drug disposal questions for the study's primary objective. 87 individuals viewed the embedded educational video on drug disposal kits and answered the final video question for the study's secondary objective.

Survey responses mostly came from residents of Mecosta and Newaygo counties. Participants were predominantly white (85.6%), female (73.2%), and had a college degree (71.2%). Over half of individuals were employed (52.6%), and more had a job in a healthcare setting than a non-healthcare workplace. Complete demographic information can be viewed in **Table 2**.

The top three methods of drug disposal were medication drop boxes (57.7%), throwing medication directly in the trash (54.6%), and flushing medication down the toilet (30.9%). See **Figure 2** for complete data related to drug disposal. When assessing counties separately, Osceola and Newaygo used medication drop boxes the most while the main method in Mecosta was placing medications directly in the trash.

Primary Objective Results

The drug disposal methods participants indicated they needed the most information for were home drug disposal kits (over 50%) and medication drop boxes (39%). When participants were categorized, no demographic factor was associated with increased or decreased use of inappropriate disposal methods some or all the time. All Pearson chi-square p-values were above 0.05. See **Table 2** for complete results.

Participants' specific number of appropriate and inappropriate drug disposal methods utilized were also assessed. Non-parametric tests of this interval data showed that the number of inappropriate drug disposal methods used did not statistically differ across any of the demographic factors assessed. See **Table 3** for complete inappropriate drug disposal results. Additionally, the number of appropriate drug disposal methods used did not differ statistically across any demographic groups except for employment setting. For employment setting, individuals working in a healthcare setting utilized significantly more appropriate drug disposal methods than those not employed in a healthcare setting ($p = 0.044$). See **Table 4** for complete appropriate drug disposal results.

Secondary Objective Results

Prior to watching the video, 62.6% of individuals thought that home drug disposal kits were safe. After the video, an increase to 86.9% ($p = 0.002$) was observed. Similarly, prior to watching the video, 34.4% of participants agreed the at-home drug disposal kits were easy to use. After watching the video, 72.6% agreed they were easy to use ($p = <0.001$). Lastly, prior to watching the video, 53.1% of respondents reported needing more information about at-home drug disposal kits versus 45.9% after the video. This reduction was not statistically significant ($p = 0.793$). See **Table 5** for complete results.

As for at-home drug disposal kit acceptance, only 23.9% of the 87 participants that completed this portion of the survey indicated they would prefer to use a kit at home over all other medication disposal methods. 39.3% of participants indicated they preferred other options, and 36.9% were neutral. 87% of survey respondents agreed they would use the product if it was free, while 57% agreed they would use it if it cost five dollars or less, and 17% indicated they would use it if it cost \$10 or less.

Other Results

Aside from the primary and secondary objectives, the survey also asked who participants thought was responsible for

creating awareness about proper drug disposal. The top three responses were pharmacists (87.6%), health departments (80.4%), and physicians (67%).

DISCUSSION

Primary Objective

Overall, this study supports increasing drug disposal education for rural residents regardless of their county of residence, age, gender, race, education level, job type, and employment setting. This matches results from a needs assessment performed in the state of Indiana, but differs from a study conducted in India which identified highest education and occupation as factors that significantly impact drug disposal behaviors.^{4,9} About 30% of each demographic subgroup used appropriate medication disposal methods all of the time. This rate of proper medication disposal is 10% higher than the proper disposal rate identified by the Indian Health Service in tribal communities.²¹ It is worth noting that the CMREN collaborative has ensured medication drop boxes are located at all pharmacies and police departments in the counties they serve. CMREN's efforts may have contributed to increased utilization of this disposal method in Mecosta, Osceola, and Newaygo counties compared to what is seen in other rural settings. However, having 70% of participants dispose of medication inappropriately some or all of the time shows that much still needs to be done to improve disposal knowledge and practices. In fact, what survey participants indicated they needed the most information about were medication drop boxes and drug disposal kits, the drug disposal strategies considered appropriate.

The only statistically significant finding for the primary objective was that healthcare workers used more appropriate drug disposal methods than non-healthcare workers. This could potentially be attributed to healthcare workers receiving more education and training on drug disposal, their workplace hosting medication take-back events, or their workplace conveniently having a medication drop box on site. However, healthcare workers still utilized equal amounts of inappropriate methods as non-healthcare workers. A previous assessment of disposal methods used by healthcare professionals also found that, despite knowing the proper methods of drug disposal, pharmacy students and nurses utilized many inappropriate options.²⁴ The fact that individuals are utilizing inappropriate disposal methods despite having knowledge on appropriate methods emphasizes an additional need for education specifically focused on the rationale for why inappropriate disposal can be harmful.

Secondary Objective

The results also support the use of a short educational video to improve attitudes on the use of home drug disposal kits. Drug disposal health communication strategies which were previously identified to be successful in rural areas included incorporating images of children into education safety and

providing step-by-step instructions on how to perform the disposal behavior.¹¹ The video utilized in this study also employed those strategies and significantly changed participants' thoughts on drug disposal kit safety and ease of use. This suggests that their continued use in other educational interventions may be beneficial moving forward. It also emphasizes the positive impact simple initiatives can have on a population, a trend seen in previously published literature.^{15,19} On the other hand, the video failed to significantly reduce participants' need for more information on the product. One article does a nice job of summarizing all home disposal kit options, how they work, directions, sizes, and pricing.² Providing key points from this as well as the link to this resource may be beneficial in future videos to address participants' information needs. As for drug disposal kit acceptance, there is much progress to be made. About one-third of participants indicated they prefer other medication disposal options over drug disposal kits. One-third was neutral, though, indicating that with proper education and access, the home kits may be something they end up preferring over other options down the road. The results also demonstrated that the lower the cost of the drug disposal kits, the more likely people are to utilize them.

Study Limitations

One limitation to this study is the sample size. The sample size may have been small because the survey was only available in an online format and individuals in rural areas may have limited to no internet access. Sample size could have also been influenced by the timing of survey distribution. The month of November is often busy for individuals in preparation for holidays, and this could have contributed to lack of desire to participate in a survey. Due to the sample size, participant demographics were grouped into fewer categories than the original survey gathered in an effort to analyze data in a meaningful way.

Another limitation is that the study population lacks diversity. Our study inclusion was made up of mostly white, college-educated women. This is secondary to participant recruitment using a convenience sampling method, the area at baseline being primarily Caucasian, and the local presence of a state university. A large proportion of participants were also healthcare workers. These demographic findings may have been due to the nature of this cross-sectional study only providing a snap shot of the community during a limited time period. It is important to note that this likely differs from other rural populations too because the counties surveyed contain a university and a large number of hospitals and medical locations. It is possible that this contributed to why medication drop boxes were used more than trash disposal. Such behavior could also be a positive reflection of current efforts already made by local organizations to improve medication disposal. Regardless, this creates potential for confounding and further reduces the generalizability of the study's results to other rural areas. The results of the secondary objective also may not be

generalizable to rural counties with lower levels of health literacy. This creates an opportunity to investigate the results of similar interventions in counties with differing populations. Additionally, future studies may benefit from addressing mechanisms for random or representative sampling strategies.

Study Strengths

Study strengths include all recruitment materials and survey questions being written at an easy level of understanding. Utilizing a 6th grade reading level in this rural setting, as advised by CMREN's feedback, likely contributed to the survey's low dropout rate of 3.5%. This low dropout rate indicates that the survey is likely a reasonable tool for use in future studies. Partnership with local organizations for distribution was also a strength for this study. Without this collaboration, the survey likely would not have reached as broad of a population and would have significantly underrepresented older age groups and non-healthcare workers. Utilizing a cross sectional study methodology helped to analyze multiple variables at the same time as well. Lastly, although the convenience sampling method was a weakness listed, in some ways it is also a strength. The survey reached individuals CMREN's partner organizations can help, and the results allowed them to customize efforts specifically for their target population's needs.

Future Considerations

Replication of this survey in other rural, underserved areas may be beneficial in the future to add to the pilot information collected in this study. If conducted again in a different area, both an online and paper form of the survey should be available. Implementation of both options was successful in a study gathering data on medication disposal in multiple tribal communities. It encouraged greater participation which, overall, leads to more accurate representation of the population being assessed.²¹

Based off this study's secondary findings, it may also be beneficial in the future to play short, educational videos to encourage use of proper drug disposal options. A previous study showed that face-to-face or verbal interventions through video increased opioid disposal by 23.2% compared to no education. Although the decrease was not statistically significant, it was still a move in the right direction.¹⁸ Opportunities for video and face-to-face education could include college student lectures, nursing homes, movie theater previews, or waiting areas in clinics.

In addition to video education, directly providing community members with an at-home drug disposal kit should be considered in the future. Patients provided Deterra, an example of an at-home drug disposal kit, after an outpatient surgery where they were prescribed an opioid were significantly more likely to dispose of their medication than those who were not.²² That said, extending the availability of such products to everyone, not just those getting surgery or being prescribed

opioids, could be a successful initiative moving forward as long as the cost to the patient is little to none. Lastly, because participants indicated pharmacists were most responsible for increasing awareness about drug disposal options, initiatives focused on increasing the disposal counseling provided by community pharmacists should be considered moving forward.

CONCLUSION

All rural residents in the study area, regardless of their demographics, would benefit from increased drug disposal education. Education should emphasize appropriate options and highlight why the remaining options are harmful or inappropriate. In this sample of mostly white, college-educated women, there was not a specific demographic group that utilized inappropriate drug disposal methods more than another. The drug disposal methods that rural residents need the most education on are at-home drug disposal kits and medication drop boxes. A short, educational video was effective for positively changing thoughts and attitudes on drug disposal kits. Similar interventions may be successful in the future to increase proper drug disposal in underserved areas.

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APPENDIX A: SURVEY QUESTIONS

Question 1

Which Michigan county do you live in?

- Mecosta >> Q2
- Osceola >> Q2
- Newaygo >> Q2
- None of the above >> Thank You Page

Question 2

Age

- Under 18 >> Thank You Page
- 18-24 >> Q3
- 25-34 >> Q3
- 35-44 >> Q3
- 45-54 >> Q3
- 55-64 >> Q3
- 65-74 >> Q3
- 75 or older >> Q3

Question 3

Gender

- Male >> Q4
- Female >> Q4
- Other >> Q4

Question 4

Race/Ethnicity

- American Indian/Alaskan Native >> Q5
- Asian >> Q5
- Black/African American >> Q5
- Hispanic/Latino >> Q5
- Native Hawaiian/Pacific Islander >> Q5
- White/Caucasian >> Q5
- Other >> Q5

Question 5

Highest Education Completed

- No formal education >> Q6
- Elementary school (grades 1-5) >> Q6
- Middle school (grades 6-8) >> Q6
- High school (grades 9-12) >> Q6
- Some college >> Q6
- Trade school >> Q6
- Associate Degree >> Q6
- Bachelor's Degree >> Q6
- Master's Degree >> Q6
- Doctoral Degree >> Q6

Question 6

Occupation

- Unemployed >> Q7
- Self-employed >> Q7
- Student >> Q7
- Employed Non-Healthcare Worker >> Q7
- Employed Healthcare Worker >> Q7

Question 7

What method(s) have you used before to dispose of unused/expired medication in your home?
Select all that apply.

- Thrown directly in the trash ▶▶ Q8
- Mixed with cat litter or coffee grounds, then thrown in the trash ▶▶ Q8
- Flushed down the toilet ▶▶ Q8
- Rinsed down the sink ▶▶ Q8
- Taken to a medication drop box at a pharmacy or police station ▶▶ Q8
- Taken to a community medication drop-off/take-back event ▶▶ Q8
- Placed in an at-home drug disposal kit/pouch ▶▶ Q8
- Other ▶▶ Q8
- I have never disposed of unused or expired medication ▶▶ Q16

Question 8

Please describe any other medication disposal methods you use. If none, leave the text box blank.

Answer text

Question 9

Disposing medication in the **trash...**

	Left Anchor			Right Anchor	
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Is safe.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Is easy for me.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Is the main way I remove medication from my home.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I want/need more information on this medication disposal option.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Question 10

Disposing medication **down the sink or toilet...**

	Left Anchor			Right Anchor	
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Is safe.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Is easy for me.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Is the main way I remove medication from my home.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I want/need more information on this medication disposal option.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Question 11

Disposing medication in **a medication drop box** at a pharmacy, police station, or other local organization...

	Left Anchor			Right Anchor	
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Is safe.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Is easy for me.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Is the main way I remove medication from my home.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I want/need more information on this medication disposal option.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Question 12

Disposing of medication at a **drug take-back event...**

	Left Anchor			Right Anchor	
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Is safe.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Is easy for me.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Is the main way I remove medication from my home.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I want/need more information on this medication disposal option.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Question 13

Disposing of medication using an **at-home drug disposal kits...**

	Left Anchor			Right Anchor	
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Is safe.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Is easy for me.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Is the main way I remove medication from my home.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I want/need more information on this medication disposal option.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Question 14

Who do you think is responsible for creating awareness about proper disposal of unused/expired medications? Select all that apply.

- Media networks
- Physicians
- Pharmacists
- Health departments
- The pharmaceutical industry
- Family members
- Law enforcement

Question 15



Please watch this short video on home drug disposal kits.

<http://youtu.be/PkWSNeq9Vfw>

Then, rank the following statements:

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
This is safe.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
This is easy for me.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I want/need more information on this medication disposal option.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would use a drug disposal kit if it was free.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would use a drug disposal kit if it was \$5 or less.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would use a drug disposal kit if it was \$10 or less.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I prefer other medication disposal options.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I understand how to use a drug disposal kit if it were provided to me.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Question 16

Why have you never disposed of unused/expired medication? *Select all that apply.*

- I do not take medication. ▶▶ Thank You Page
- I keep medication for possible future needs. ▶▶ Thank You Page
- I do not know how to dispose of medication. ▶▶ Thank You Page
- I forget to get rid of medication. ▶▶ Thank You Page
- I do not check medication expiration dates. ▶▶ Thank You Page
- I give unused/expired medication to friends or family members. ▶▶ Thank You Page

APPENDIX B: RECRUITMENT MATERIALS



YOU ARE INVITED TO PARTICIPATE IN AN ANONYMOUS SURVEY ON...

MEDICATION DISPOSAL IN RURAL MICHIGAN

THE SURVEY IS 15 QUESTIONS AND TAKES ABOUT 10 MINUTES TO FINISH.

IF INTERESTED AND YOUR PHONE HAS INTERNET ACCESS, PLEASE SCAN THIS QR CODE WITH YOUR CAMERA. THIS WILL BRING YOU TO THE SURVEY'S INFORMATION AND QUESTIONS. THANK YOU FOR YOUR CONSIDERATION!



Email Script

You are invited to participate in an anonymous survey that has been developed by a pharmacy student. The student is interested in knowing more about medication disposal in rural counties. The survey is 15 questions and is estimated to take 10 minutes to finish. If interested in participating, please follow the link below. It provides complete survey information, and then access to the questions. IRB Approved Project #: IRB-FY20-21-203
Survey link: <https://www.questionpro.com/t/ATJ65ZnfCv>

Thank you for your consideration!

Table 1: Survey Participant Characteristics (N = 97)

Demographic	Group	Participants, n. (%)
County of Residence	Mecosta	54 (55.7)
	Osceola	6 (6.2)
	Newaygo	37 (38.1)
Age	18-24	25 (25.8)
	25-34	12 (12.4)
	35-44	8 (8.2)
	45-54	11 (11.3)
	55-64	17 (17.5)
	65 and older	23 (23.7)
Gender	Male	25 (25.8)
	Female	71 (73.2)
Race/Ethnicity	White/Caucasian	83 (85.6)
	Black/African American	1 (1)
	Asian	4 (4.1)
	American Indian/Alaskan Native	1 (1)
	Hispanic/Latino	2 (2.1)
	Middle Eastern	1 (1)
	Multiracial	4 (4.1)
Highest Education Completed	High School	7 (7.2)
	Some College	19 (19.6)
	Trade School	2 (2.1)
	Associate Degree	18 (18.6)
	Bachelor's Degree	29 (29.9)
	Master's Degree	15 (15.5)
	Doctoral Degree	7 (7.2)
Job Status	Unemployed Student	16 (16.5)
	Employed Student	10 (10.3)
	Unemployed Non-Student	25 (25.8)
	Employed Non-Student	41 (42.3)
Employment Setting	Healthcare	34 (66.7)
	Non-Healthcare	17 (33.3)

Table 2: Pearson Chi-Square Results (N = 97)

Demographic Factor, n. (row %)		Only Used Appropriate Disposal Methods	Used Inappropriate Disposal Methods All or Some of the Time	Pearson Chi-Square P-value
County of Residence	Mecosta	13 (21.4)	41 (75.9)	0.849
	Osceola	1 (16.7)	5 (83.3)	
	Newaygo	10 (27)	27 (73)	
Age	18-34	8 (21.6)	29 (78.4)	0.461
	35-64	8 (22.2)	28 (77.8)	
	65 and older	8 (34.8)	15 (65.2)	
Gender	Male	7 (28)	18 (72)	0.687
	Female	17 (23.9)	54 (76.1)	
Race/Ethnicity	White/Caucasian	21 (25.3)	62 (74.7)	0.756
	Other	3 (21.4)	11 (78.6)	
Highest Education Completed	High School	3 (42.9)	4 (57.1)	0.582
	Some College/Trade School	6 (28.6)	15 (71.4)	
	Undergraduate Degree	11 (23.4)	36 (76.6)	
	Graduate Degree	4 (18.2)	18 (81.8)	
Job Status	Unemployed Student	2 (12.5)	14 (87.5)	0.663
	Employed Student	3 (30)	7 (70)	
	Unemployed Non-Student	7 (28)	18 (72)	
	Employed Non-Student	10 (24.4)	31 (75.6)	
Employment Setting	Healthcare	10 (29.4)	24 (70.6)	0.344
	Non-Healthcare	12 (20.7)	46 (79.3)	

Table 3: Number of Inappropriate Drug Disposal Methods by Demographic Factor (N = 97)

Mann-Whitney U test was utilized for demographics with 2 categories.		
Demographic Factor		P-value*
Gender	Male	0.797
	Female	
Race	White/Caucasian	0.939
	Other	
Employment Setting	Healthcare	0.680
	Non-healthcare	
Kruskal-Wallis ANOVA test was utilized for demographics with 3 or more categories.		
Demographic Factor		P-value*
County of Residence	Mecosta	0.945
	Osceola	
	Newaygo	
Age	18-34	0.247
	35-64	
	65 and older	
Highest Education Completed	High School	0.086
	Some College/Trade	
	Undergraduate Degree	
	Graduate Degree	
Job Status	Unemployed Student	0.416
	Employed Student	
	Unemployed Non-Student	
	Employed Non-Student	

*Null hypothesis: The distribution of number of inappropriate drug disposal methods used is the same across the demographic's groups.

Table 4: Number of Appropriate Drug Disposal Methods by Demographic Factor (N = 97)

Mann-Whitney U test was utilized for demographics with 2 categories.		
Demographic Factor		P-value*
Gender	Male	0.856
	Female	
Race	White/Caucasian	0.078
	Other	
Employment Setting	Healthcare	0.044
	Non-healthcare	
Kruskal-Wallis ANOVA test was utilized for demographics with 3 or more categories.		
Demographic Factor		P-value*
County of Residence	Mecosta	0.154
	Osceola	
	Newaygo	
Age	18-34	0.971
	35-64	
	65 and older	
Highest Education Completed	High School	0.765
	Some College/Trade	
	Undergraduate Degree	
	Graduate Degree	
Job Status	Unemployed Student	0.976
	Employed Student	
	Unemployed Non-Student	
	Employed Non-Student	

*Null hypothesis: The distribution of number of appropriate drug disposal methods used is the same across the demographic's groups.

Table 5: Drug Disposal Kit Educational Video Impact

Statement Assessed	% Participants that Agreed Before the Video (N = 87)	% Participants that Agreed After the Video (N varies [^])	Wilcoxon Rank Test P-Value*
#1: Disposing of medication using at-home drug disposal kits is safe.	62.6	86.9	0.002
#2: Disposing of medication using at-home drug disposal kits is easy.	34.4	72.6	<0.001
#3: I need more information on disposing of medication using an at-home drug disposal kit.	53.1	45.9	0.793

*Null hypothesis: The median of differences in Likert scale scores on this statement before and after the educational video is zero.

[^]87 participants answered the pre- and post-video assessment questions, but some participants did not provide Likert scale rankings for all statements after the educational video. For statement #1, only 83 participants provided a response. For statement #2, only 82 participants provided a response. For statement #3, only 85 participants provided a response.

Figure 1: Survey Participant Exclusions and Dropouts

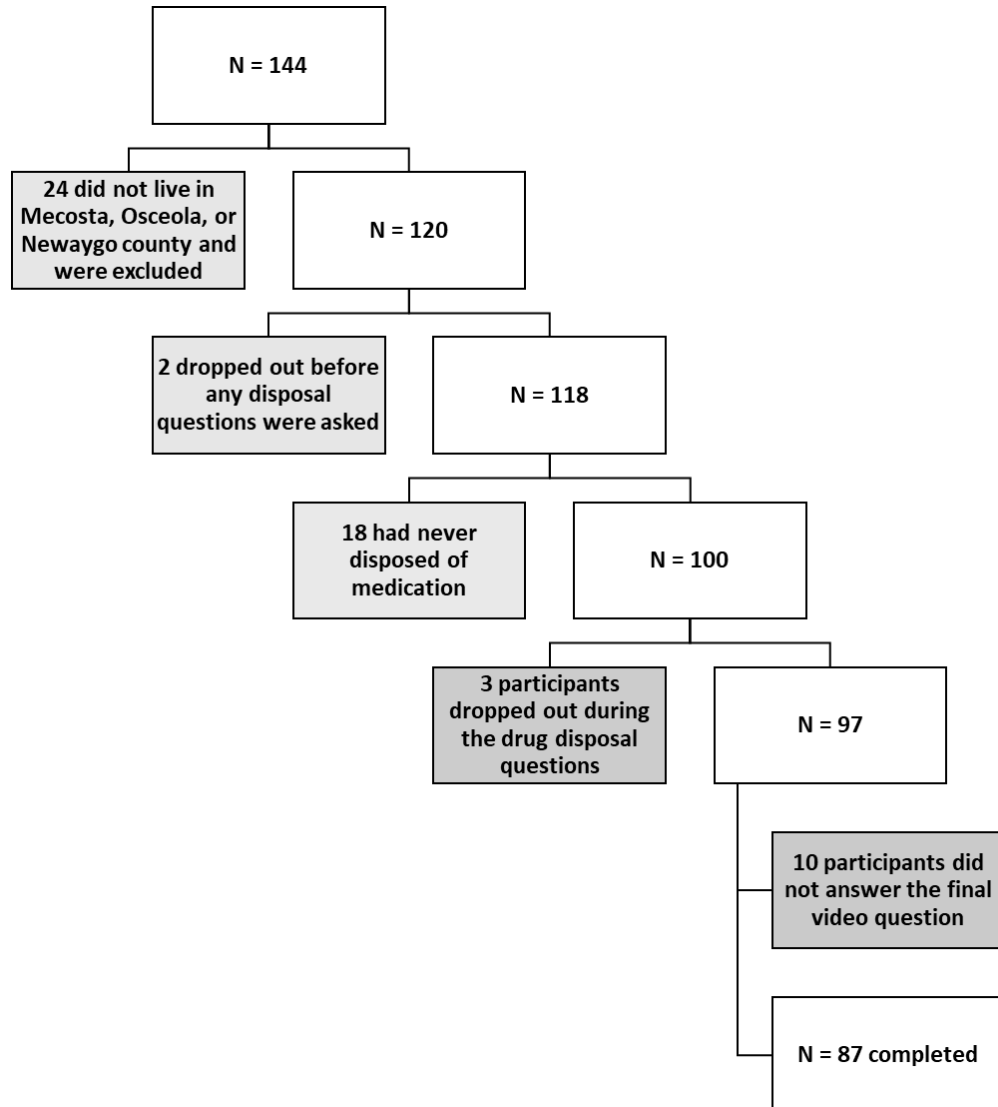


Figure 2: Drug Disposal Methods Utilized by All Counties (N = 97)

